# Space Weather Technical Forecast

Issued on Tuesday, 26 April 2022 at 01:26 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

**Space Weather Forecast Headline: Chance of M-class flares (R1/R2 Radio Blackouts), with a slight chance of X-class flares (R3 Radio Blackouts).**

**Analysis of Space Weather Activity over past 24 hours**
**Solar Activity:** Solar activity has been Moderate, with two M-class flares observed from AR2993 (Dki/beta-Gamma) which is a large, complex and slowly evolving region in the northwest quadrant. The largest of these was a M1.2 flare at 25/0118UTC. Adjacent to this is AR2994 (Eki/Beta-Gamma) which is similarly large, complex and slowly evolving. This second region was responsible for a number of C-class flares through the last 24 hours. Three of the remaining four regions are simple beta regions in the centre disc or the northeast quadrant, with one alpha region in the southeast quadrant. No Earth-directed CMEs have been observed on available imagery.

**Solar Wind / Geomagnetic Activity:** The solar wind, as observed at L1 by the ACE and DSCOVR spacecraft, has been slightly elevated, but gradually declining from an average of 450km/s to 420km/s. Density has been below average throughout the period. Overall magnetic field strength was weak, with the north-south component, Bz also varying weakly. The phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet.

**Energetic Particles / Solar Radiation:** The high energy proton flux (10 MeV) was at background levels throughout. The high energy electron flux (greater than 2MeV) has been at background to moderate levels throughout. The associated 24 hour fluence was below the Active (1e8 integrated pfu) level, with 1.07e7 integrated pfu recorded at 25/2100 UTC.

**Four-Day Space Weather Forecast Summary**
**Solar Activity:** Solar activity is expected to be Low, with a likelihood of some Moderate activity. This is due initially to two significant regions in the northwest quadrant, with further active regions likely to rotate onto the southeast quadrant later in the period. There is an additional slight chance of High activity.

**Solar Wind / Geomagnetic Activity:** A CME which left the Sun on 21 April was due to glance the Earth on 24 April. This is now presumed to have missed the Earth. The high speed stream (HSS) from coronal hole 77 is expected to decline towards background through 26 April. Speeds are then likely to increase either late on 28 April or during 29 April as the Earth connects with the HSS from coronal hole 78, giving estimated speeds of 500km/s. Geomagnetic activity is expected to be mainly Quiet, with Unsettled intervals on 26 April, but then mainly Quiet on 27 April. There is a slight chance of Active to G1/Minor Storm intervals on 28 and 29 April due to the forecast onset of the next coronal hole high speed stream.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

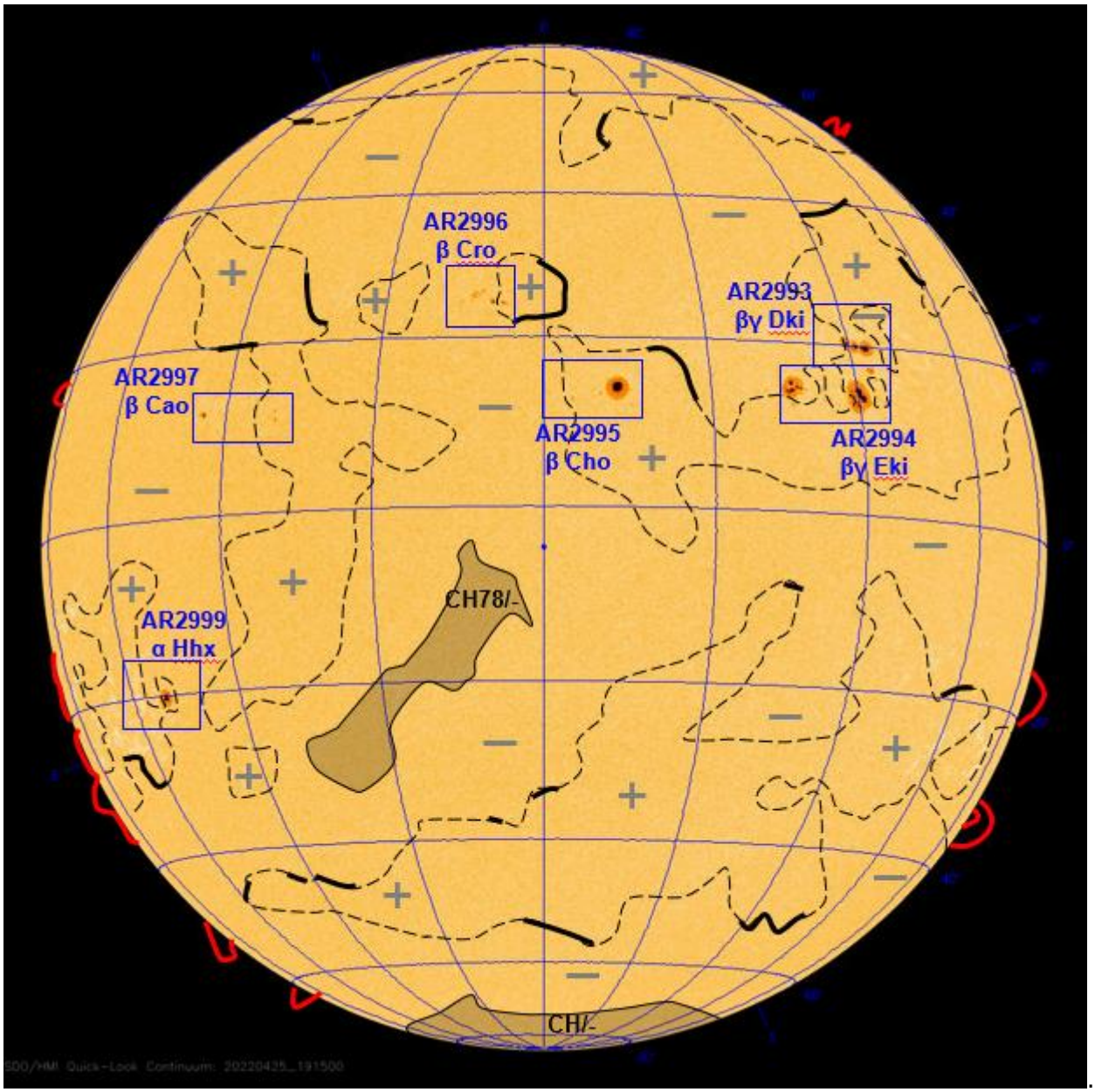
© Crown Copyright 2022. All Rights Reserved.

**Energetic Particles / Solar Radiation:** The high energy proton flux (greater than 10 MeV) is at background levels, and is most likely to remain so through the next four days. However, two significant regions are now transiting the northwest quadrant and together bring a slight chance of solar radiation storms reaching Earth. The high energy electron flux (greater than 2MeV) is expected to be at mainly background to moderate levels, perhaps rising slightly through the period. Electron fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, with a rising trend towards the end of the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

**Figure 1. Solar Analysis Valid 25/2000UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

# Met Office Space Weather Technical Forecast

## Geomagnetic Storms:

A CME which left the Sun on 21 April, was due to glance Earth on 24 April with low confidence and is now presumed to have missed the Earth. No further CMEs are forecast to affect the Earth during the forecast period.

The high speed stream from coronal hole 77 is due to wane during day 1 (26 April). The next feature of note is coronal hole 78, which is at centre disc, and based on an estimated high speed stream of 500km/s, is forecast to connect with Earth during day 3 (28 April) or perhaps early on day 4 (29 April). This estimate and forecast may be revised as the effects of the coronal hole are observed at STEREO A, which is currently three days ahead of Earth's orbit.

Geomagnetic activity is expected to be mainly Quiet, with Unsettled intervals on day 1, but then mainly Quiet on day 2. There is a slight chance of Active to G1/Minor Storm intervals on days 3 and 4 due to the forecast onset of the next coronal hole high speed stream.

| Geo-Magnetic Storm<br>Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 1 | 1 | 10 | 5 |
| Strong | G3 | No | 1 | 1 | 1 | 1 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

## Geomagnetic Activity - Earthbound Coronal Mass Ejections

None expected

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

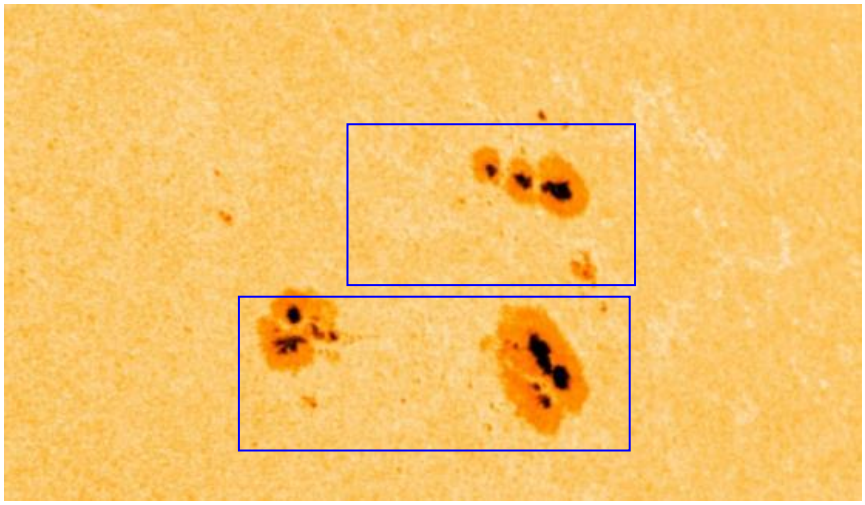
**Radio Blackouts - X-Ray Flares:**
Solar activity is expected to be mainly Low to Moderate through the next four days. There is also a slight chance of High activity.

There are two significant sunspot regions, AR2993 (Dki/Beta-Gamma) and AR2994 (Eki/Beta-Gamma) in the northwest quadrant, which continue to produce M-class flares. The remaining regions on the visible disc are all magnetically simple with simple sunspot configurations. A number of filaments are being monitored for potential eruptions, especially in the western hemisphere which could result in an Earth-directed CME.

As the two significant sunspot regions rotate towards the western limb, further regions are likely to appear across the eastern limb over the next two days. One of these regions, which is two to three days from moving onto the visible disc, appears particularly active and was responsible for a recent farsided CME.

| X Ray Flares | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability | | | (%) | (%) | (%) | (%) |
| Active | R1-R2 M Class | No | 60 | 60 | 60 | 60 |
| Very Active | R3 to R5 X Class | No | 10 | 10 | 10 | 10 |

**Figure 2: HMI intensitygram and magnetogram imagery of AR2993 and AR2994 in the northwest quadrant at 25/2330UTC.**



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

**Figure 3: 24-hour X-ray flux**

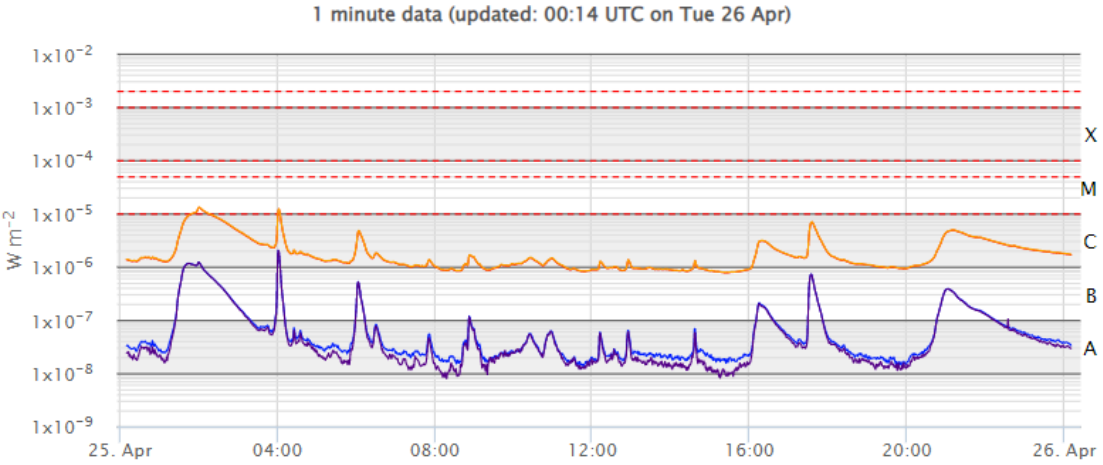
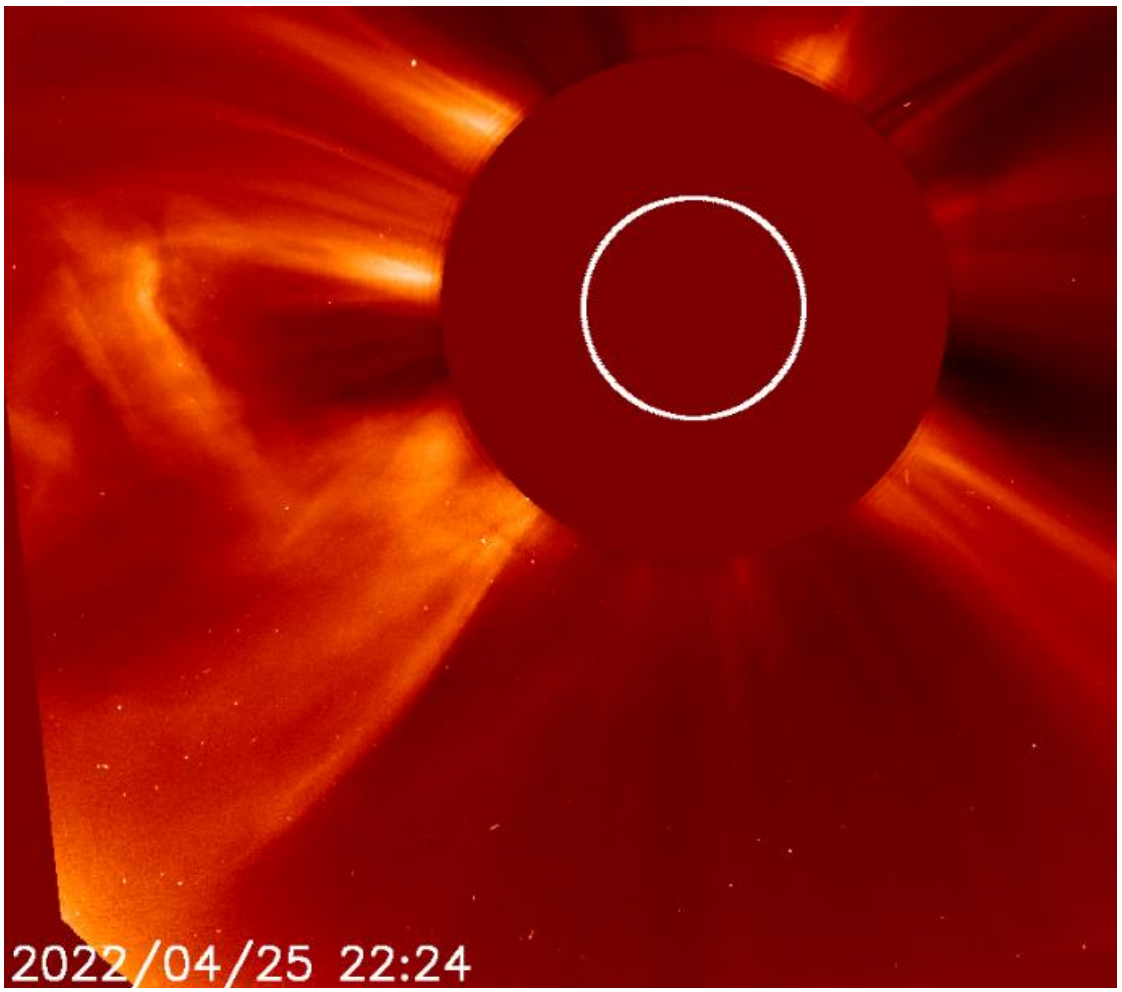



**Figure 4: SOHO LASCO C2 imagery, with a CME eruption clearly visible to the left of the occultation disc. This was a far-sided eruption just beyond the eastern limb and gives an indication of the activity of active regions due to rotate onto the disc.**




Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

## Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at Background levels, and is most likely to remain so through the next four days. However, AR2993 and AR2994 both bring the possibility of isolated high M-class to low X-class flares. As they continue to move across the northwestern quadrant there is a slight, but increasing, chance that solar radiation storms from any such events may be observed at Earth.

| Radiation Storms Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ S1** | No | 10 | 10 | 10 | 10 |
| **Very Active** | **≥ S3 *** | No | 1 | 1 | 1 | 1 |
| * S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$) | | | | | | |

## High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) at GEO is expected to be at mainly background to moderate levels through days 1 and 2, due to a lack of input from a slightly elevated high speed stream. Any build up of electrons in the radiation belts is more likely from days 3 and 4 due to the next coronal hole high speed stream, but this could be inhibited by potential geomagnetic activity.

Electron fluence levels are well below the Active threshold with this expected to continue through the next four days, but with a rising trend towards the end of the period due to the forecast high speed stream.

| GEO Electron Environment Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) (%) | Day 2 (00-24 UTC) (%) | Day 3 (00-24 UTC) (%) | Day 4 (00-24 UTC) (%) |
|---|---|---|---|---|---|---|
| **Active** | **≥ 2 MeV ≥ $1x10^8$** | No | 1 | 1 | 10 | 10 |
| **Very Active** | **≥ 2 MeV ≥ $1x10^9$** | No | 1 | 1 | 1 | 1 |

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.